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REVIEW

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General and oral health implications of cannabis use

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Abstract

Cannabis, commonly known as marijuana, is the most frequently used illicit drug in Australia. Therefore, oral health care providers are likely to encounter patients who are regular users. An upward trend in cannabis use is occurring in Australia, with 40 per cent of the population aged 14 and above having used the drug. There are three main forms of cannabis: marijuana, hash and hash oil, all of which contain the main psychoactive constituent delta-9-tetrahydrocannabinol (THC). Cannabis is most commonly smoked, however it can be added to foods. THC from cannabis enters the bloodstream and exerts its effects on the body via interaction with endogenous receptors. Cannabis affects almost every system of the body, particularly the cardiovascular, respiratory and immune systems. It also has acute and chronic effects on the mental health of some users. Therefore, chronic abuse is a concern because of its negative effects on general physical and mental health. Cannabis abusers generally have poorer oral health than non-users, with an increased risk of dental caries and periodontal diseases. Cannabis smoke acts as a carcinogen and is associated with dysplastic changes and pre-malignant lesions within the oral mucosa. Users are also prone to oral infections, possibly due to the immunosuppressive effects. Dental treatment on patients intoxicated on cannabis can result in the patient experiencing acute anxiety, dysphoria and psychotic-like paranoiac thoughts. The use of local anaesthetic containing epinephrine may seriously prolong tachycardia already induced by an acute dose of cannabis. Oral health care providers should be aware of the diverse adverse effects of cannabis on general and oral health and incorporate questions about patients' patterns of use in the medical history.

Key words: Cannabis, oral health, THC.

Abbreviations and acronyms: DMF = decayed, missing, filled teeth in the secondary dentition; THC = delta-9-tetrahydrocannabinol.

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INTRODUCTION

Australian oral health care providers commonly treat patients who use cannabis because it is one of the most commonly used illicit drugs for recreational purposes.[1] This paper examines various aspects of cannabis use and abuse to provide a better understanding of this drug. Cannabis has been cultivated and used since the beginning of civilization, with uses ranging from ropes and clothes, to foods and medicines.[2] Cannabis contains a unique group of chemicals, namely cannabinoids, some of which are psychoactive.[3] Their effects work through an endogenous cannabinoid receptor system in the human body.[4] The discovery of this system in the late 1980s prompted researchers to explore a wide range of potential medical applications of cannabis. However, despite these potential benefits, the non-medical use of cannabis can have adverse effects on the general and mental health of users particularly when used regularly for an extended period of time.[3]

Cannabis the drug

Cannabis preparations are derived from the plant *Cannabis sativa*, a plant which has male and female forms.[1] The plant contains more than 60 types of cannabinoids[1] produced by small glands on the surface of the plant.[2] The main psychoactive constituent is the cannabinoid delta-9-tetrahydrocannabinol (THC).[3] The concentration of THC varies with its source and preparation.[1,3] The amount of THC is highest in the fine droplets of sticky resin present on the female flower heads.[2] THC is also found in lesser quantities in the leaves, stems and seeds.[1]

There are three main forms of cannabis namely, marijuana, hashish and hash oil. Marijuana is the most common and least concentrated form (0.5-5 per cent THC), consisting of dried leaves and flowers.[1] Hashish (2-20 per cent THC) consists of resin from flower heads compressed to form small light brown or black blocks.[1,2] Hash oil (15-50 per cent) is a thick, oily liquid extracted from hashish, and is the most potent form.[2]

Routes of administration

Smoking marijuana is the most common and efficient way of using cannabis as it is easy to prepare and its effects are rapid.[2] Marijuana is smoked in a hand-rolled

cigarette which may contain varying amounts of tobacco to assist burning and, on average, 0.5-lg of leaves.[1-2] A typical joint contains 0.5-1g of leaves.[2] A variety of pipes are also used to smoke marijuana, the most common being a water pipe ('a bong'); smoke is sucked through a layer of water, which cools it and removes some of the tar and irritants.[2] Smokers inhale deeply and hold their breath to maximize absorption.[1]

Hashish can be baked and eaten in foods such as cookies and cakes because it is soluble in fats and alcohol.[2] It may also be mixed with tobacco and smoked,[1] or heated and the vapours inhaled.[2] More commonly, hash oil is spread on the tip or paper wrapping of a cigarette and smoked.[1]

Cannabis use in Australia

Cannabis is the most commonly used illicit drug in Australia, with 40 per cent of the population aged 14 and above (over five million people) having tried cannabis, and 18 per cent having used it in the last 12 months.[1,5] As many as 45 per cent of 14-19 year olds and 64 per cent of 20-29 year olds have used cannabis at least once in their life.[1] There is a decline in the age of first use of cannabis among younger cannabis users.[1] Early use increases the chance of becoming regular cannabis users (cannabis used on five or more days in a 14-day period),[6] with 7 per cent of users developing dependence.[7] Cannabis use typically begins during mid-adolescence and peaks in late adolescence and young adulthood.[7] The main source of cannabis is from friends or acquaintances (71 per cent), a dealer (14 per cent) or home-grown (5 per cent).[5]

Cigarette smokers are more likely to be users of cannabis than non-smokers (27 versus 8 per cent). Similarly, regular alcohol users (20 per cent) are more likely than occasional (10 per cent) or non-drinkers (4 per cent) to have used cannabis.[8] In Australia, the percentage of Aboriginal people using marijuana is 8.5 per cent, compared to 6.5 per cent for other Australian born and 3.4 per cent for overseas-born users.[5]

Pharmacology

When smoked approximately 50 per cent of the THC is absorbed through the lungs and enters the bloodstream, from where THC reaches the brain within seconds; its effects are apparent within minutes.[3,9] Peak levels of THC occur within 10 minutes of smoking and decline to 5 to 10 per cent of initial levels within an hour.[1] THC is metabolized in the liver and forms the major metabolite 11-hydroxy-THC which is also a psychoactive agent.[3,10] Being highly lipophilic, THC accumulates in adipose tissue and is then slowly released back into the body.[3,9] The tissue elimination half-life of THC is approximately seven days, and total elimination may take up to 30 days.[3] When ingested, the amount of cannabis absorbed is 25 to 30 per cent less than that of smoking the same amount due to the first-pass metabolism by the liver. Therefore, the onset of the effects is delayed by about 30 minutes to two hours, but the duration of effects is prolonged.[2,9]

Cannabis exerts its effects on the body by interaction with specific endogenous receptors, CB_1 and CB_2.[4] These receptors normally modulate neuronal activity by affecting second messenger and ion transport systems.[3,4] CB_1 receptors are found in the cerebral cortex, limbic areas, basal ganglia, cerebellum and thalamic areas, explaining the mental health effects of cannabis.[3,4,9] CB_2 receptors are found in cells in the immune system, predominantly the macrophages.[3,4] Cannabis overdose causing death is unlikely due to the small number of receptors in the brainstem.[3,9]

Cannabis abuse and general health

The widespread use of cannabis is a concern because of its negative effects on the general physical health of users. The use of cannabis affects almost every system in the body[3] (the effects depending on the dosage and route of administration of THC), and the general health of the user.[3]

The acute effects of THC on the cardiovascular system include a dose-related tachycardia of up to 50 per cent with widespread vasodilation.[3,11,12] An elevated heart rate increases cardiac workload and myocardial oxygen demand.[11,12] This may result in cardiac ischaemia in susceptible individuals.[11] The concentration of carboxyhaemoglobin from absorbed carbon monoxide is high because of the smoking pattern of deep inhalation and long inspiratory time.[11,12] This also decreases the oxygen levels to the heart.[12] Furthermore, the analgesic properties of THC may delay the treatment of chest pain related to stable angina or angina pectoris.[12]

The effects of cannabis use on the respiratory system are mainly associated with the long-term smoking of marijuana.[3,13] The smoke from a cannabis cigarette has the same contents as tobacco smoke, except for nicotine. This includes carbon monoxide, bronchial irritants, tar and higher levels of other carcinogens than in tobacco smoke.[3,13] Chronic smokers of cannabis have increased symptoms of bronchitis, including coughing, wheezing and sputum production, and emphysema.[13,14] The symptoms of bronchitis are more common in cannabis-only smokers than non-smokers.[14] The pulmonary effects of long-term use of 3-4 marijuana cigarettes a day is equivalent to smoking 20 or more tobacco cigarettes a day.[3,13] This difference is related to the differing pattern of smoking (deep inhalation) and the absence of a filter in marijuana cigarettes. Smoking one marijuana cigarette results in the inhalation of three times the amount of tar, and one-third more tar retained in the respiratory tract compared to one tobacco cigarette.[13] Alveolar macrophages, the key cells in respiratory defence, are found in greater numbers in marijuana smokers.[13] However, their ability to phagocytose is impaired, predisposing the individual to respiratory infections.[13,15]

Table 1. Medical uses of marijuana

Anti-emetic agents/Hunger and appetite	Control nausea and vomiting and improve appetite in cancer patients undergoing chemotherapy and in patients with HIV-related wasting[9,20]
Analgesics	Treat patients with severe chronic pain such as in rheumatoid arthritis by suppressing the spinal processing of nociceptive messages selectively without altering the activity of non-nociceptive neurons[20,21]
Anti-asthmatic agents	Increase the lung's capacity to absorb oxygen by bronchodilation[9]
Anti-glaucoma agents	Reduce the intraocular pressure in glaucoma patients by influencing the ocular fluid outflow pathways[22]

Cannabinoids modulate immune cell function through the widespread distribution of CB_2 receptors in immune cells.[13,16] THC has an immunosuppressive effect on macrophages, natural-killer cells, T and B lymphocytes. This results in decreased host resistance to bacterial and viral infections.[16,17] These immunosuppressive effects include suppressing lymphocyte proliferation and antibody production to cytotoxic activity.[17] The normal functions of macrophages are suppressed by inhibiting the release of nitric oxide (NO), an antibacterial effector molecule, and other important cytokines of the immune system.[18] These cytokines include tumour necrosis factor-alpha (TNF-a), Interleukin-6 (IL-6) and eicasanoid prostaglandin ($PGE_{2)}$, which are normally secreted by macrophages in response to bacterial endotoxin and lipopolysaccharide (LPS).[18] THC also increases IL-1 secretion and processing by macrophages; IL-1 is associated with apoptosis, or programmed cell death, in human mononuclear leukocytes.[19] Furthermore, cannabinoids are known to suppress host immune reactivity against tumour growth.[18]

Medical use of marijuana

Cannabis has had a long history of medical and therapeutic use in several parts of Asia to treat difficulty of child labour,[20] pain, convulsions, spasm and nausea.[21] Even though the medical use of cannabis declined by the beginning of the twentieth century, there is still a wide variety of potential applications in modern medicine (Table 1).[20,21,22]

Cannabis abuse and mental health

Cannabis has acute and chronic effects on mental health (Table 2). Acute effects vary greatly between individuals as the degree and severity is generally related to the dosage, method of administration, and environment and personality of the user.[3] Long-term abuse increases the risk of serious psychiatric illness.[4,23,24]

Cannabis abuse and oral health

Generally, cannabis abusers have poorer oral health than non-users, with higher decayed, missing and filled (DMF) teeth scores, higher plaque scores and less healthy gingiva.[25] An important side effect of cannabis is xerostomia.[26,27] Thus, chronic use of cannabis may increase the risk of caries.[26]

Cannabis smoking and chewing causes changes in the oral epithelium, termed 'cannabis stomatitis'; this includes leukoedema of the buccal mucosa and hyperkeratosis. Acute signs and symptoms include irritation and superficial anaesthesia of the oral epithelium, sialostasia and xerostomia.[25] With chronic use, 'cannabis stomatitis' presents as chronic inflammation of the oral epithelium and leukoplakia, which may progress to neoplasia.[25]

Cannabis can elicit variable parasympathetic effects, which in association with a stress response, such as a visit to the dentist, may be associated with syncopal episodes.[25] Dental treatment on intoxicated patients can result in the patient experiencing acute anxiety, dysphoria and psychotic-like paranoiac thoughts. The use of local anaesthetic solutions containing

Table 2. Acute and chronic mental effects of marijuana

Acute effects	Chronic effects
Mood[3]	Psychosis and schizophrenia[4,23,24]
– Euphoria	– Link with earlier onset and increased severity in predisposed individuals
– Sense of detachment	
– Relaxation	
– Anxiety attacks with increased dose	
Psychosis[23]	Depression, anxiety and low motivation[24]
– Confusion	– Link with increased risk
– Disorientation	
– Auditory and visual hallucinations	
Perception[3]	Withdrawal and dependence[23]
– Intensified ordinary sensations	– Restlessness
– Distorted time perception	– Irritability
– Impaired judgement of distance	– Insomnia
Cognition and memory[3]	Cognitive function[23]
– Impaired cognitive function	– Impaired in memory
– Short-term memory loss	– Impaired ability to organize and integrate complex information

Table 3. Dental implications of treating cannabis users

- Cannabis abusers generally have poor oral and periodontal health.
- Cannabis intoxicated patients may experience acute anxiety and dysphoria during dental treatment.
- Local anaesthetic containing epinephrine may prolong tachycardia following an acute dose of cannabis.
- Chronic smokers of cannabis have an increased risk of developing oral leukoplakia and oral cancer, oral candidiasis and other oral infections.

epinephrine may seriously prolong tachycardia already induced by an acute dose of cannabis.[11,25] Table 3 summarizes the dental implications of treating cannabis users.

Cannabis use and oral cancer

Marijuana-related oral cancer usually occurs on the anterior floor of the mouth and the tongue.[28,29] The mechanism by which marijuana smoke acts as a carcinogen relates to the presence of aromatic hydrocarbons, benzopyrene and nitrosamines[28,30] in amounts 50 per cent greater than the same amount of tobacco smoke.[13]

Marijuana smoke is associated with dysplastic changes within the epithelium of the buccal mucosa (anucleated squamous cells, immature cell forms, increased nuclear pleomorphism and increased mitotic activity and abnormalities).[25] Smoking marijuana is associated with oral premalignant lesions, including leukoplakia and erythroplakia.[31] The association between marijuana use and head and neck cancer was stronger among younger patients (<50 years old).[29] The long-term prognosis in young patients with head and neck cancer is poorer than in older ones. This relates to the tumours being more aggressive in younger patients, requiring more radical treatment such as widespread resection and radiotherapy.[30] A synergistic effect between tobacco and marijuana smoke has been observed, suggesting the interactions of different risk factors further increases the risk of developing oral cancer.[29] The association between the presence of oral papilloma and cannabis smoking may be related to suppression of the immune response by cannabis[26] but the human papilloma virus may also play an important role.[26]

Oral candidiasis and the intra-oral prevalence and density of candidal species are increased in cannabis smokers,[32] perhaps due to the presence of hydrocarbons in marijuana, which act as an energy source for certain candida species.[32] Additional factors such as compromised immune response due to chronic use of marijuana, poor denture hygiene, and nutritional factors should also be considered.[26]

Cannabis use and the periodontium

A painful, 'fiery-red' gingivitis with associated white patches has been documented on the gingiva of cannabis smokers.[25] Diffuse gingival hyperplasia and concurrent alveolar bone loss has also been noted in chronic abusers of cannabis.[25] However, for both conditions, other aetiologies were not fully considered and therefore supporting evidence is lacking.

Current knowledge on the effects of cannabis on periodontal health is inadequate. Controlled epidemiologic studies are difficult to undertake as the frequency, amount, duration and mode of administration of cannabis differ amongst individuals. Personal risk factors including age, oral hygiene, general health, concurrent tobacco smoking and poly drug use make it difficult to identify the specific influence of cannabis abuse on susceptibility to periodontitis.

CONCLUSION

The increasing prevalence of cannabis use in the Australian community demands that oral health care providers are aware of the diverse adverse effects of cannabis abuse. As dental professionals, it is timely to incorporate queries about patients' patterns of cannabis use as part of the medical history, just as enquiries about tobacco smoking have been added to the medical history in recent times.

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